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EFFICACY OF NEW MOLECULES, SPINOSAD AND MONOCROTOPHOS ON THE INCIDENCE OF *CNAPHALOCROCIS MEDINALIS* GUENEE UNDER *KHARIF* RICE CROP ECOSYSTEM OF MANIPUR VALLEY

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ABSTRACT

Two sets of field trials were conducted to evaluate the efficacy of new molecules. Spinosad and Monocrotophos on the incidence of Cnaphalocrocis medinalis Guenee in rice var. KD-2-6-3. The study revealed that Flubendiamide 39.35 SC @ 24 g a.i.ha^{-1} was found quite effective against C.medinalis with lower mean leaf damage LD incidence of 0.19% during 2013 and 0.24% LD during 2014 as against 1.95% LD (2013) and 2.00% LD (2014) in untreated control plots respectively followed by Thiamethoxam 25 WG @ 25 g.a, i-ha^{-1} (0.28%LD 2013) and (0.33%LD 2014). The highest mean grain yield 6.03 ha^{-1} (2013) and 6.02 t ha^{-1} (2014) was harvested from the plots treated with Flubendiamide 39.35.SC.

KEYWORDS: Cnaphalocrocis medinalis, Flubendiamide, Kharif, KD-2-6-3, Grain Yield

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Original Article

INTRODUCTION

Insect pests are the major constraints in enhancing rice productivity besides disease and weeds. (Behura et al, 2001). Among the major insect pest of rice leaf folder (LF) Cnaphalocrocis medinalis Guenee is considered as the most nuisance of high level of nitrogenous fertilizer and cloudy weather with low sunlight. Bentur (2011) Sellamal Murugesan and Chelliah (1983) reported that a 10 per cent increase in flag leaf damage by the leaf folder reduces grain yield by 0.13g per tiller and the number of filled grains by 4.5 per cent. Nugaliyaddle et al. (1997) reported leaf folder alone cause 22% and yield losses because of leaf folder ranged from 63 to 80% (Alvi et al., 2003 and Leonard Geanessi 2014). Arshad et al (2012) reported percentage of filled grain, 1000 grain weight and grains yield varied significantly with leaf folder infestation. Farmers rely heavily on insecticides for pest management. But indiscriminate use of such persistent insecticide leads to consequences in insecticide resistance resurgence, secondary pest outbreak leading to environmental contamination and persistent residual toxicity (Khan and Khaliq, 1989, Kushwaha, 1995, Satpathi et al 2005 and Wakil et al 2001). To overcome increasing problems associated with the strategy of exclusive and indiscriminate use of pesticides. Integrated pest management (IMP),which is an Ecological Approach" to pest management. Uses of eco- friendly pesticides are environmentally safe and also offer an attractive ways to completely replace the use of synthetic pesticide except in very few cases. Introduction of new selective insecticides non- toxic to natural enemies has improved the management of rice insect pest (Kumar, 2010). New molecules are eco- friendly effective, low dose selective and target specific. (Shanon, 2014). Hence new molecules are being added for their evaluation with an aim to restore

environmental quality. From all these facts and findings it is noteworthy to determine the effect of new molecules on the incidence of leaf folder insect pest in rice var KD-2-6-3 which will help in understanding the through knowledge of the points of understanding the acclamalizational qualities environmental impact, developmental factors adaptability of IPM (Integrated pest management) measures in dreadful pest of rice management. In view of this, the present study was undertaken to evaluate the efficacy of new molecules spinosad, and monocrotophos on the incidence of Cnaphalocrocis medinalis against rice leaf folder.

MATERIALS AND METHODS

Field experiment was conducted in randomized block design (RBD) replicating thrice with a plot size of 5x4m^2 and spacing of 15x20cm at the Rice Research Farm, College of Agriculture, Central Agricultural University, Imphal which is situated at 24^{o}45$'$N latitude and 93^o 56$'$ E longitude with an elevation of 790m above the mean sea level. The soil type was clay loam in texture and acidic in reaction having pH value of 5.5. The meteorological data recorded during the period of experimentation are collected from ICAR, Lamphelpat, Imphal.

The high yielding variety "KD-2-6-3" was used for the experiment. Eight new molecules, Spinosad and Monocrotophos were tested. There was an untreated control in each replication. Observation on LF damaged leaves and total leaves were recorded from 10 randomly selected hills per plot at one day before and 3,7,10 and 15 days after each application. The percentage infection was determined by using the following formula

$$\text{Infestation (\%)} = \frac{\text{Number of infested leaves per hill}}{\text{Total number of leaves per hill}} \text{ x } 100$$

Estimation of Grain Yield

The crop was harvested when 85 per cent of the grain matured in all the treatment. The grain yield of each plot was recorded and computed to tones per hectare by using the formula IRRI (1976).

$$\text{Adjusted weight} = \frac{100-M}{86} \text{ x } w$$

W= Weight of the grain

M= percent moisture content of the grain.

Statistical Analysis

Mean value of data obtained from the experiment were subjected to statistical analysis after suitable transformation to test significance as per suggested by Gomez and Gomez (1984) for results interpretation.

Experimental Observations

The composite mean data of two sprays on the incidence of Cnaphalocrocis medinalis Guenee showed in Table 1 & 2 revealed that the mean leaf damage differed significantly among the treatments throughout the experimental period of Kharif 2013 and 2014 respectively. At 3DAA during (2013) mean leaf damage (LD) varied from 0.11 to 1.18 per cent in the insecticidal treated plots as against 3.76% LD in untreated control plots. Flubendiamide 39.35 SC (0.11%LD) exhibited significantly lowest per cent leaf damage followed by Imidacloprid 17.8 SL (0.23%LD), Thiamethoxam 25 WG (0.35%LD) and Fipronil 80WG (0.44%LD). At 7DAA, the lowest mean extent of leaf damage (0.19%LD) was recorded in the plots treated with Flubindiamide 39.35 SC and Fipronil 0.3 G as against 2.29 per cent in untreated plots. At 10DAA,

Fipronil 0.3G was observed as the lowest leaf damage with 0.09 per cent as against 1.09 per cent in untreated control followed by Flubendiamide 39.35 SC (0.12%LD), Thiamethoxam 25 WG (0.23%LD), Thioclopride 21.70SC (0.24%LD), Monocrotophos 36WSC (0.34%LD) and at 15DAA the minimum percentage of leaf damage incidence of 0.17 was observed in Thiamethoxam 25 WG as against 1.09 in untreated control plots. It was a par with Imidacloprid 70 WG (0.19%LD) and Thiocloprid 21.70 SC (0.23%LD). (Table1)

Table 1: Relative Effect of Certain Molecules on the Incidence of Leaf Folder *(C. medinalis)* in Rice Var. 'KD-2-6-3 during Kharif, 2013

Treatment	Dose g a.i. ha^{-1}	[2]Mean Leaf Damage (%)		Pooled Mean	[1]Composite Mean incidence (population) over 1st & 2nd sprays				Grain Yield ($t.ha^{-1}$)
		1st Spray	2nd Spray		3DAA	7DAA	10DAA	15DAA	
T_1= Imidacloprid 17.8 SL	25	0.32 (3.64)	0.94 (5.39)	0.63 (4.52)	0.23 (3.26)	1.00 (5.57)	0.78 (4.09)	0.52 (4.28)	4.86
T_2= Thiamethoxam 25 WG	25	0.19 (2.54)	0.37 (3.51)	0.28 (3.03)	0.35 (3.37)	0.41 (3.53)	0.23 (2.83)	0.12 (2.38)	5.69
T_3= Imidacloprid 1.8% SP	25	0.73 (4.66)	0.89 (5.34)	0.81 (5.00)	1.8 (5.74)	1.04 (5.94)	0.64 (4.46)	0.38 (3.87)	4.73
T_4= Imidacloprid 70 WG	25	0.46 (3.80)	0.77 (4.69)	0.62 (4.25)	0.66 (4.24)	1.19 (6.32)	0.48 (3.82)	0.14 (2.62)	5.06
T_5= Thiocloprid 21.70 SC	120	0.44 (3.55)	0.42 (3.71)	0.43 (3.63)	0.60 (4.08)	0.69 (5.00)	0.24 (2.83)	0.18 (2.62)	5.52
T_6=Flubendiamide 39.35 SC	24	0.11 (2.35)	0.27 (3.21)	0.19 (2.78)	0.11 (2.62)	0.19 (2.75)	0.12 (2.38)	0.35 (3.37)	6.03
T_7= Spinosad 2.5% SC	50	0.32 (3.04)	0.91 (5.48)	0.62 (4.26)	0.71 (5.07)	1.00 (5.43)	0.48 (3.05)	0.29 (3.50)	4.36
T_8= Fipronil 0.3 G	50	0.22 (2.87)	0.80 (4.74)	0.51 (3.81)	0.72 (5.03)	0.19 (2.75)	0.09 (2.38)	1.04 (5.07)	5.39
T_9= Fipronil 80 WG	40	0.29 (3.28)	0.50 (4.22)	0.40 (3.75)	0.44 (3.90)	0.45 (4.04)	0.32 (3.37)	0.38 (3.69)	5.96
T_{10}=Monocrotophos 36 WSC	500	0.42 (3.34)	0.57 (4.46)	0.50 (3.90)	0.64 (4.46)	0.64 (4.80)	0.34 (2.47)	0.37 (3.87)	5.15
T_0 = Untreated Control	--	2.04 (6.96)	1.85 (7.58)	1.95 (7.27)	3.76 (10.27)	2.29 (8.24)	1.04 (5.78)	0.63 (4.80)	4.12
CD (P=0.05)		**1.33**	**0.93**	**0.30**	**1.91**	**1.06**	**0.52**	**0.51**	**0.50**

Figures in parentheses are angular transformed values ;

[1]Composite means of 3 replications recorded at 3, 7, 10 and 15 DAA ;

[2]Mean of three replications based on two sprays.

Note: Nursery application of all the insecticides was made at 7 days prior to uprooting.

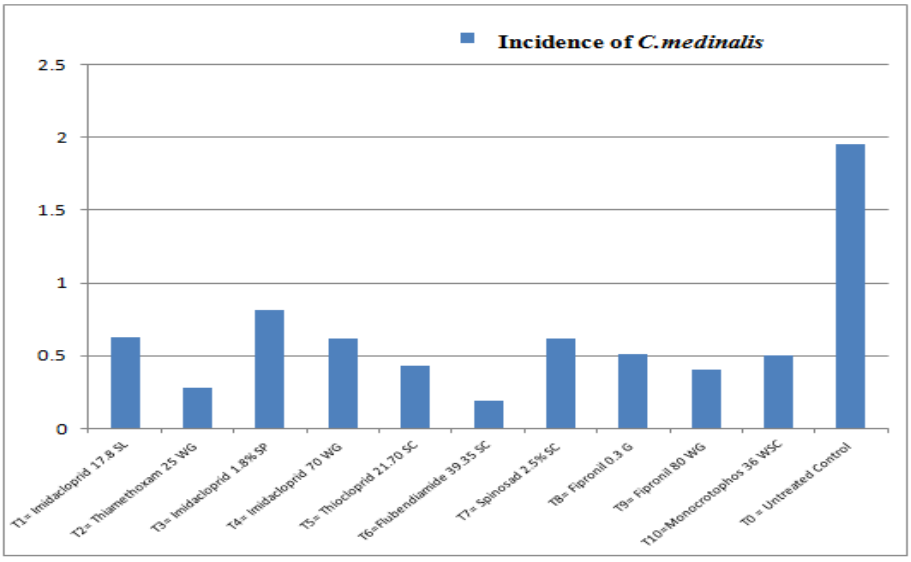

Figure 1: Incidence of Leaf Damage by C.Medinalis During Kharif 2013

During Kharif 2014, (Table 2 & Figure 2) at 3DAA, leaf damage varied from 0.16 to 1.23 per cent leaf damage (LD) in the insecticidal treated plots as against 3.81% LD in untreated control plots. Flubendiamide 39.35 SC (0.16%LD) registered the lowest leaf damage par which was at Imidacloprid 17.8 SL (0.28%LD) Theamethoxam 25 WG (0.40%LD) and Fipronil 80WG (0.49%LD). At 7DAA, the lowest mean extent of leaf damage was observed as 0.24%LD in the plots treated with Flubendiamide 39.35SC and Fipronil 0.3G as against 2.34 per cent in untreated plots. In 10 DAA lowest leaf damage with 0.09 per cent was observed in the plots treated with Fipronil 0.3G and followed by Flubendiamide 39.35 SC (0.24%LD) and Monocrotophos 36 WSC (0.34%LD). At 15 DAA the plot treated with Thiamethoxam 25WG registered the lowest leaf damage with 0.17%LD as against 1.09%LD in untreated control plots. It was at par with Imidacloprid 70WG (0.19%LD) and Thiocloprid 21.70 SC (0.23%LD).

Table 2: Relative Effect of Certain Molecules on the Incidence of Leaf Folder *(C. medinalis)* in Rice Var. 'KD-2-6-3 during Kharif, 2014

Treatment	Dose g a.i. ha^{-1}	[2]Mean Leaf Damage (%)		Pooled Mean	[1]Composite Mean incidence (population) over 1st & 2nd sprays				Grain Yield (t ha^{-1})
		1st Spray	2nd Spray		3DAA	7DAA	10DAA	15DAA	
T_1= Imidacloprid 17.8 SL	25	0.37 (3.69)	1.00 (5.44)	0.68 (4.57)	0.28 (3.57)	1.05 (5.64)	0.83 (5.09)	0.57 (4.33)	4.85
T_2= Thiamethoxam 25 WG	25	0.24 (2.59)	0.42 (3.56)	0.33 (3.02)	0.40 (3.42)	0.46 (3.58)	0.28 (2.88)	0.17 (2.43)	5.67
T_3= Imidacloprid 1.8% SP	25	0.78 (4.71)	0.94 (5.39)	0.86 (5.05)	1.23 (5.79)	1.09 (5.99)	0.69 (4.51)	0.43 (3.92)	4.72
T_4= Imidacloprid 70 WG	25	0.51 (3.85)	0.82 (4.74)	0.67 (4.30)	0.71 (4.29)	1.24 (6.37)	0.53 (3.87)	0.19 (2.67)	5.05
T_5= Thiocloprid 21.70 SC	120	0.49 (3.60)	0.47 (3.76)	0.48 (3.67)	0.65 (4.13)	0.74 (5.05)	0.29 (2.88)	0.23 (2.67)	5.51
T_6=Flubendiamide 39.35 SC	24	0.16 (2.40)	0.32 (3.26)	0.24 (2.83)	0.16 (2.67)	0.24 (2.80)	0.17 (2.43)	0.40 (3.42)	6.02
T_7= Spinosad 2.5% SC	50	0.37 (3.09)	0.96 (5.53)	0.67 (4.31)	0.76 (5.12)	1.05 (5.48)	0.53 (3.10)	0.34 (3.65)	4.35
T_8= Fipronil 0.3 G	50	0.27 (2.92)	0.85 (4.79)	0.56 (3.86)	0.77 (5.08)	0.24 (2.80)	0.14 (2.43)	1.09 (5.12)	5.38
T_9= Fipronil 80 WG	40	0.34 (3.33)	0.55 (4.27)	0.45 (3.80)	0.49 (3.95)	0.50 (4.09)	0.37 (3.42)	0.43 (3.74)	5.95

Table 2: Contd.,									
T_{10}=Monocrotophos 36 WSC	500	0.47 (3.39)	0.62 (4.51)	0.54 (3.95)	0.69 (4.51)	0.69 (4.85)	0.39 (2.52)	0.42 (3.92)	5.14
T_0 = Untreated Control	--	2.09 (7.01)	1.90 (7.63)	2.00 (7.32)	3.81 (10.32)	2.34 (8.29)	1.14 (5.83)	0.68 (4.85)	4.11
CD (P=0.05)		**1.34**	**0.94**	**0.31**	**1.92**	**1.07**	**0.53**	**0.52**	**0.49**

Figures in parentheses are angular transformed values;

[1]Composite means of 3 replications recorded at 3, 7, 10 and 15 DAA;

[2]Mean of three replications based on two sprays.

Note: Nursery application of all the insecticides was made at 7 days prior to uprooting.

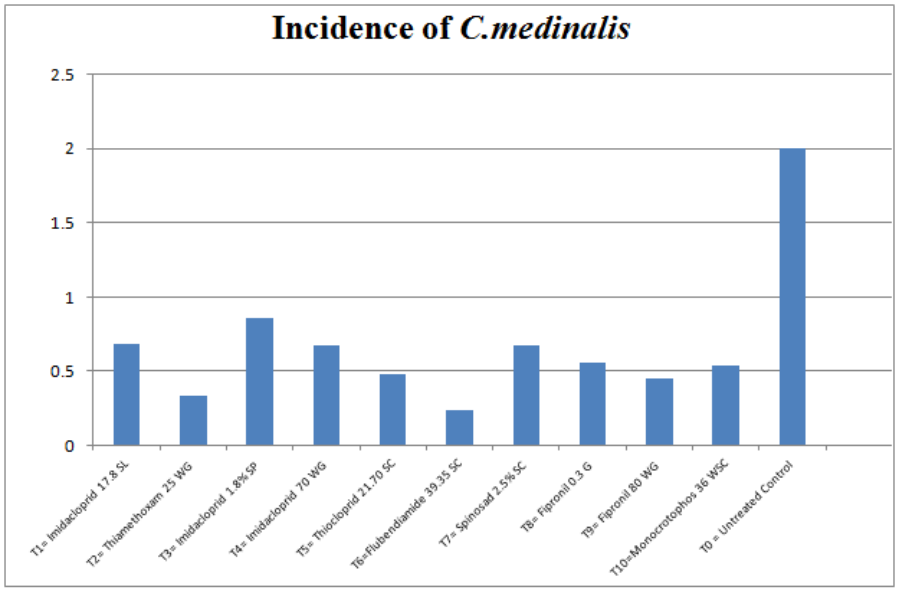

Figure 2: Incidence of Leaf Damage by *C. medinalis* during Kharif 2014

During Kharif season of 2013, the pooled mean data of two spray revealed that Flubendiamide 39.35 SC applied @ 24 g a.i. ha^{-1} performed significantly better than rest of the insecticidal treatments with a value of minimum leaf damage incidence (0.15% LD) as against 1.95% in untreated check which was at par with Thiamethoxam 25 WG treatment recording lower mean leaf damage incidence of 0.28%. The percentage mean leaf damage recorded in the plots treated with Fipronil 80 WG @ 40 g a.i. ha^{-1} (0.40% LD), Fipronil 0.3 G @ 50 g a.i. ha^{-1} (0.51% LD) and Thiocloprid 21.70 SC @ 120 g a.i. ha^{-1} (0.43% LD) had non-significant difference from each other. However, all the insecticidal treatments were effective in restricting the infestation due to leaf folder when compared with untreated control. The treatments of Imidacloprid 1.8 SP did not perform satisfactorily as compared to other insecticidal treatments and proved least effective against the pest with a record of maximum mean extent of leaf damage (0.81% LD). The mean leaf damage recorded in the rest insecticidal treatments was varied from 0.50% (Monocrotophos 36 WSC @ 500 g a.i. ha^{-1}) to 0.63% (Imidacloprid 17.8 SL @ 25 g a.i. ha^{-1}).(Table 1 & Figure 1) Flubendiamide proved to be highly effective against leaf folder and was at par with Spinosad Indoxacarb and Fipronil (Kulagod et al. 2011). Sikh et al.(2007) have also reported the superiority of Flubendiamide 480 SC @ 24 and 30g a,i. ha^{-1} against leaf folder on rice. Anon (2006) has reported the damage suppression

efficacy of Flubendiamide (4.4 per cent damage leaf) and Spinosad (4.7 percent damage leaf) compared to 11.0 per cent damage leaf in untreated control against leaf folder damage on rice crop. The present findings agree with their results.

During 2014, (Table 2 & Figure 2) the two sprays' mean leaf damage data indicated that Flubendiamide 39.35 SC applied @ 24 g a.i. ha^{-1} shows significantly better than rest of the insecticidal treatments with a value of minimum leaf damage incidence (0.24% LD) as against 2.00% LD in untreated check which was at par with Thiamethoxam 25 WG treatment observing lower mean leaf damage incidence of 0.33%. The percentage mean leaf damage recorded in the plots treated with Fipronil 80 WG @ 40 g a.i. ha^{-1} (0.45% LD), Fipronil 0.3 G @ 50 g a.i. ha^{-1} (0.56% LD) and Thiocloprid 21.70 SC @ 120 g a.i. ha^{-1} (0.48% LD) which had non-significant difference from each other. The treatment of Imidacloprid 1.8 SP did not perform satisfactorily as compared to other insecticidal treatments and proved least effective against the pest with a record of maximum mean extent of leaf damage (0.86% LD). The mean leaf damage recorded in the rest insecticidal treatments was varied from 0.54% (Monocrotophos 36 WSC @ 500 g a.i. ha^{-1}) to 0.68% (Imidacloprid 17.8 SL @ 25 g a.i. ha^{-1}).

RESULTS AND DISCUSSIONS

From the above discussion it shows that the effectiveness of Flubendiamide, Thiamethoxam and Fipronil 80 WG in controlling the leaf folder might be attributed due to their systemic action and long residual toxicity against the pest. The present finding is in conformity with that of Rath and Nayak (2013). Shekh et al, (2007) Toshaishi et al (2005) Panda et al (2004) However, a contradicting result was reported by Kumar et.al (2010), where they found its inferiority in controlling the pest in compared with other synthetic organic insecticides, which might be due variation in weather condition of the location, variety used, pest load and number of applications. Kartikeyan et.al (2013) reported that Flubendiamide + Buprofizin was the most effective treatment against major rice pests and was superior in efficacy over all the treatments including that of check insecticides with 17.1 per cent reduction of leaf folder over the check insecticide Monocrotophos.

Kartikeyan et al (2013) states that the grain yield was increased in the combination product Flubendiamide (4%) + Buprofezin (20%) @ 857 ml/ha, Flubendiamide (125ml/ha), Buprofezin (800ml/ha), Dinotefuran (600 & 800g/ha) and Monocrotophos (1390ml/ha) sprayed plot by 20.4 and 22.9 per cent over the check insecticide treated and control plots. In 117 experiments conducted by IRRI over 15 years, insecticide treated plots yield 87% higher then the untreated (Pathak & Khan 1994). From the present study the yield data during 2013 showed that the highest yield of 6.03 t $ha^{-1}$was registered in the plot treated with Flubendiamide 39.35 SC @ 24 g a.i.ha^{-1} followed by Fipronil 80 WG @ 40 g a.i. ha^{-1} with 5.96 t. ha^{-1} and during 2014 the highest yield of 6.02 t. ha^{-1} was observed in the plot treated with Flubendiamide 39.35 SC @ 24 g a.i.ha^{-1} followed by Fipronil 80WG @ 40 g a.i.ha^{-1} with 5.96 t.ha^{-1}. The present study clearly indicate that use of Flubendiamide 39.35 SC and Fipronil 80WG has been one of the significant contributing factors to increase rice production.

CONCLUSIONS

The present study revealed that new molecules Flubendiamide 39.35 SC and Fipronil 80WG can be used for effective management of rice leaf folder *(Cnaphalocrocis medinalis)* especially in the Kharif crop ecosystem of Manipur valley.

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